REMARKS

Status

Claims 1-69 are pending and under examination. Claims 63-66 were objected to as being dependent upon a rejected base claim, but were otherwise allowable. The remaining claims stand rejected over a single reference: Claims 1-62 were rejected as allegedly anticipated by Lipshutz *et al.* (U.S. Pat. No. 6,043,080). Claims 67-69 were rejected as allegedly obvious in view of Lipshutz *et al.* Applicants respectfully traverse these rejections.

Claims 1 and 12 are amended in this response. Support for the amendments is replete in the specification and discussed below. The channel dimensions of claim 12 find support at, *e.g.*, page 20, lines 26-28 of the specification. The amendments are made without prejudice to prosecution of the original claims in this or a related application.

The Present Invention

The claimed invention is directed to a microfluidic device that has

- a *loop channel* communicating with one or more service channels;
- one or more microvalves;
- a pump associated with the loop channel.

Claims 1-62 and 67-69 were rejected as anticipated or obvious in view of Lipshutz et al. However, as explained below, the Lipshutz device does not include a loop channel, and differs in a variety of other ways from the claimed invention.

A loop channel is a channel that can be temporarily isolated from other channels to form a *closed* path through which fluid may be actively *circulated*. An exemplary loop channel of the invention is illustrated in Figure 17 and for convenience is shown schematically below.

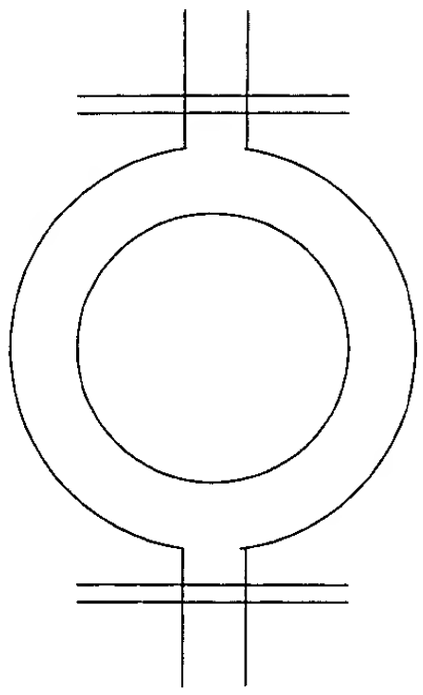

Figure 17

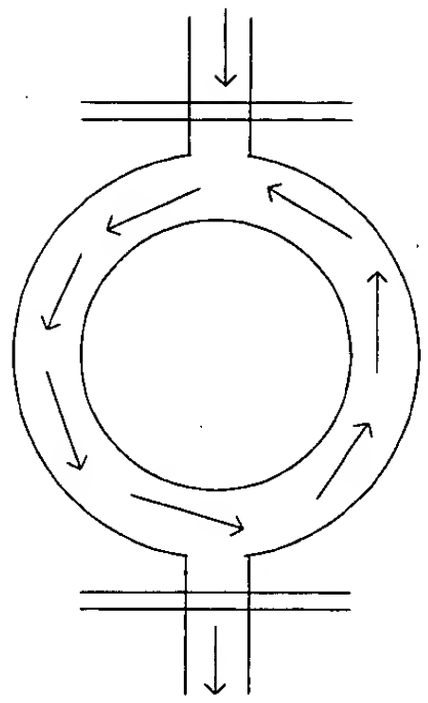

Figure 17

In this figure, the pairs of horizontal parallel lines represent valves that may be closed. The illustration on the right shows the recirculation of fluid in the loop channel.[1]

Another exemplary loop channel of the invention has a non-circular configuration and is illustrated in Figure 20 and shown schematically (without service channels) below.

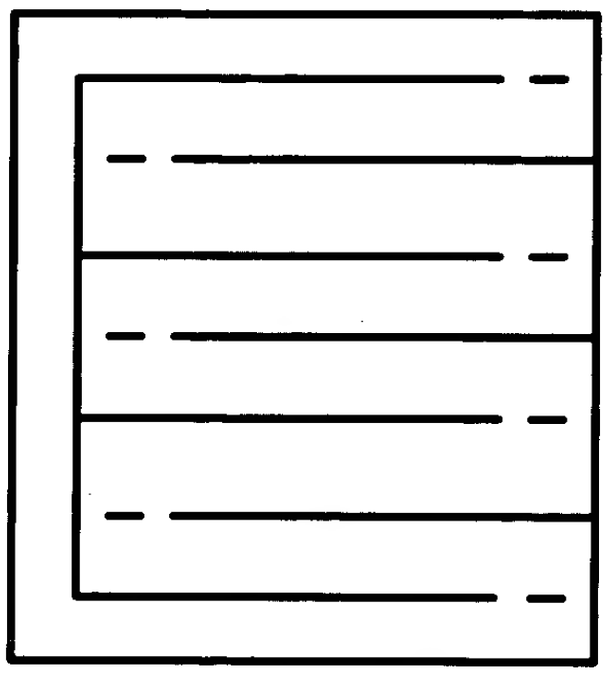

Figure 20

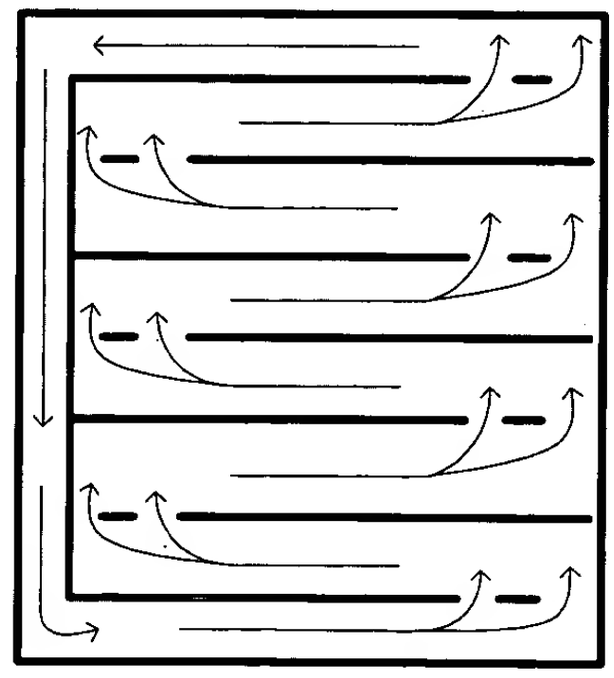

Figure 20

It would be clear to the skilled artisan reading the specification that a *loop channel* is a channel that can be temporarily isolated from other channels to form a *closed* path through which fluid may be actively

[1] The illustration above is provided for convenience and is intended to be analogous to Figure 17 of the specification; however, the Examiner is encouraged to also refer to the original figure.

circulated. Claim 1 has been amended to explicitly call out features of the loop channel, *i.e.*, a device with a loop channel communicating with one or more service channels and *having one or more microvalves situated such than when said microvalves are closed said loop channel is a closed path.* Support is replete in the specification (e.g., page 1, line 18 "The loop can be closed by microvalves . . . interposed between inlet or outlet channel and the loop channel"; page 19, lines 26-29 "In one embodiment, probes are fixed in discrete locations on a glass substrate in a pattern corresponding to the path of an adjacent treatment channel, or loop, which can comprise any closed path, i.e. it can be temporarily isolated from the rest of the chip, for example by closing valves in any channels which lead into or out of the loop"; and page 90, lines 22-24 "The peristaltic pump circulates fluid within the loop 105. The loop 105 can be closed or isolated from other fluid channels 101 by closing the valves on the in and/or out sides of the loop 105." It will be appreciated that this clarifying amendment is not intended to change the scope of the claim.

The Lipshutz Device Has No Loop Channel

The Office states that Lipshutz described an apparatus having a loop channel communicating with one or more service channels, a microvalve separating the loop channel from the service channel; and a pump associated with the loop channel. However, Lipshutz *did not* describe a "loop channel" either explicitly or inherently.

For illustration Applicants refer to Lipshutz's Figure 5A, which was asserted by the Office to show a loop channel having a circular configuration. Applicants respectfully submit that Figure 5A has not been accurately interpreted. In the Figure 5A diagram of the Lipshutz *et al.* reference there are several structures *represented as circles*, but there are no loop channels. Thus, in the Figure 5 device a fluid sample is introduced into the device through sample inlet 502, enters sample collection chamber 504, and is transported to central chamber 508 via fluid channel 506. Once within the central chamber, the sample may be transported to one of a number of reaction/storage/analytical chambers (510, 512, 514) which are arranged around and fluidly connected to the central chamber. No *loop* channel is described. Further, while with the device of the instant invention reagents can be mixed by being circulated through the loop channel the Lipshutz device requires that reagents be mixed by repeatedly pulling and pushing the mixture to and from the storage chamber 510 (col. 20, lines 58-63), or by using acoustic or ferromagnetic means (col. 25, line 36-col. 26, line 17).

The other figures of Lipchutz also describe devices entirely dissimilar from the instant invention. Lipshutz does not describe or suggest a microfluidic device with a loop channel communicating with one or more service channels, one or more microvalves situated such than if the microvalves are closed the loop channel is a closed circuit, and a pump associated with the loop channel, wherein the loop channel

Lipshutz Did Not Describe A Device With Target Molecules Patterned On The Surface Of A Loop Channel.

Claims 34-35, 40-41 and 62 are directed to a device comprising a loop channel in which target molecules are patterned on the surface of the loop channel. Insofar as Lipshutz did not describe any loop channel, a device having target molecules patterned on the surface of a loop channel cannot be anticipated or and are not suggested.

Furthermore, in rejecting the claims, the Office relied on col. 2, lines 15-33; col. 5, lines 1-21; and col. 11, lines 33-47 of Lipshutz as allegedly showing target molecules on the surface of a loop channel. However, Lipshutz described a polymer array situated in a *hybridization or reaction chamber*. The instant invention, in which target molecules are patterned on the surface of a loop channel is quite different and has significant advantages. As explained in the instant specification, an advantage of certain embodiments of the present invention is that, to improve the speed and accuracy of detection and minimize the amount of sample needed, microvalves can be used to drive a peristaltic pumping action that moves the sample around and around the loop channel for continuous and or repeated exposure to the probes. In an embodiment, the sample passes each probe several or many times, meaning that all sample molecules (e.g. DNA) will eventually and relatively quickly find and bind (hybridize) with matching targets (e.g. polynucleotide probes) at the right hybridization spots. See, e.g., page 12, lines 7-16 of the specification. This device was not described or suggested in Lipshutz.

Lipshutz Did Not Describe Or Suggest the Device of Claim 31

Claims 31-50 and 53-66 are directed to a microfluidic device with a treatment layer having elastomeric fluid channels comprising, in addition to a loop channel, "*a control layer adjacent to the treatment layer and having elastomeric control channels, wherein at least one control channel intersects each of the inlet and outlet channels to form microvalves, and at least three control channels intersect the loop channel to form a peristaltic pump*." In addition to lacking a loop channel, the Lipshutz reference does not describe a control layer adjacent to the treatment layer and having elastomeric control channels, wherein at least

one control channel intersects each of the inlet and outlet channels to form microvalves, and at least three control channels intersect the loop channel to form a peristaltic pump. The Office states that the Lipshutz apparatus "inherently comprises" control lines (in the form of electrical circuitry). However, "control lines" do not constitute a "control layer" as disclosed in the instant specification. Similarly, the Office states that Lipshutz discloses a diaphragm valve, a rupture membrane, a pressurized fluid system and the like. *Even accepting, solely for the sake of argument*, that Lipshutz described each component listed by the office, Applicant believes it beyond dispute that Lipshutz did not describe the claimed invention, which comprises elements with defined spatial and functional relationships. It is well established that to anticipate a prior art publication must not merely "contain" all of the claimed elements of the claim being challenged, but they must be arranged as in the claimed device. A claim is not anticipated by elements that are not arranged as required by the claim. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990); *Brown v. 3M* 60 USPQ2d 1375 (Fed. Cir. 2001).

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

Randolph Ted Apple
Reg. No. 36,429

TOWNSEND and TOWNSEND and CREW LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: 650-326-2400
Fax: 415-576-0300

60492414 v1